COAMPS User Support

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LONG-TERM GOALS

The long-term goal of this project is to continue to provide support (e.g., consultation, code updates, training, data transfer, etc.) for those users of the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS®[1]) who obtain the system through the release of the code as determined by release guidelines. The active distribution of COAMPS to the general scientific community cannot be accomplished without support from NRL-Monterey. To fully realize the development potential of the COAMPS system, the Navy must leverage research being performed in the community at large. Through increased usage of COAMPS by the broader community, NRL has been able to leverage discoveries, leading to advances in COAMPS capabilities including microphysics, numerical methods, and coupled modeling.

OBJECTIVES

One of the primary objectives of this project is to develop and improve our comprehensive technical support capability for the COAMPS users, particularly those who have projects supported by ONR. Components in the support structure include, but are not limited to: improving/updating to the COAMPS web site, updating versions of the code as necessary, updating the COAMPS documentation, providing user feedback to COAMPS developers, providing users with tools to obtain NOGAPS data for COAMPS initial and boundary conditions, observations data (both atmospheric and ocean) for historical cases, and maintaining/updating all of the supporting databases.

APPROACH

Since the start of this project in 2010 we have been updating and maintaining the COAMPS code releases through a two-tiered system as recommended by the COAMPS Process Action Team. In 2010 we released a new version of COAMPS (V4.2.2) to tier-2 users. V4.2.2 has multiple new features in both the model physics (e.g. an option for PBL scheme) and the analysis code (e.g., the code for creating sea surface temperature fields). We have been providing support and consultation services to users through email communications and occasionally hosting on-site visitors who need to have more in-depth knowledge about the COAMPS system. In 2011 an on-site two-and-half-day training class was conducted that was well received by our users. The user support website has been updated continuously for code releasing, posting changes in data archiving system, and new online tutorial.

[1] COAMPS is the registered trademark of the Naval Research Laboratory.

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New development and updates to the COAMPS code have also been achieved through leveraging recent research conducted by external collaborators. One example is the successful real-time COAMPS forecasts at 4-km resolution over the continental US performed by scientists at University of Oklahoma. We provided detailed consultation assisting their effort.

WORK COMPLETED

The following work was completed in FY12 (milestones are italicized):

1. Continue to develop the online tutorial page, providing users with step-by-step instruction
The on-line tutorial website has been improved substantially with the training lab material. The website provides users with step-by-step instructions for using COAMPS, from downloading the code, compiling it on various computers, obtaining NOGAPS and observational data for IC/BC, running the model, and visualizing the model output. We put significant efforts in making this site easy to follow for new users.

2. Facilitate user-developer communication
We continued to provide routine user support. While doing this, we connected users with developers for more in-depth knowledge of the code. Our communications with users have been collected and compiled as new addition to answers to the Frequently Asked Question (FAQ), which is available to users online.

3. Periodically update the COAMPS documentation by compiling an addendum.
The COAMPS V4.2.2 system has been updated greatly since the publication of the COAMPS documentation (COAMPS, Version 3 Model Description). An addendum has been written to reflect recent code changes, including options for a PBL scheme, dissipative heating, and modification of the drag coefficient under high winds. We also suggest users to select different ice nucleation formulation to remove upper level cloud ice bias. The addendum has been published at the COAMPS training website for COAMPS users' easy access.

4. Continue to develop and improve COAMPS functional interoperability with the WRF physics parameterization suite. Continue to work as a liaison between the COAMPS developers, the WRF community, and the DTC.
Leveraging efforts under the HFIP and COAMPS-TC projects, we continue to improve COAMPS functional interoperability with WRF physics. The Thompson microphysics has been implemented in COAMPS-TC and systematically tested for its impact on both synoptic environment and tropical cyclone (TC) forecasts. The WRF YSU boundary layer scheme has also been implemented in COAMPS-TC and used for idealized TC tests. We have been actively involved with WRF and DTC activities in inter-model comparisons. We have also obtained from NOAA Hurricane Research Division radar and dropsonde composite, which are useful for COAMPS-TC evaluation in TC boundary layer structure and inner core structure. Our successful collaboration with CIRA (Cooperative Institute for Research in the Atmosphere) at the Colorado State University in satellite synthetic imagery has provided us effective tools for validation of upper level cloud fields.

5. Release updates and bug fixes
We have released a bug fix for the SST analysis code. An update has been made to the instruction on how to obtain NOGAPS and observational data at the GODAE server due to the changes in the archival system at GODAE. A series of update to the COAMPS code have been released, including a

second option for PBL schemes, computation of dissipative heating, and modified drag coefficients for high winds.

6. Provided routine user support

In the past year we received 95 registration requests to use COAMPS from both the US and international institutions (e.g. Britain, India, Italy, Norway, and Vietnam), of which 41 were approved by NRL. We communicated with users through emails on daily basis to provide guidance and data.

RESULTS

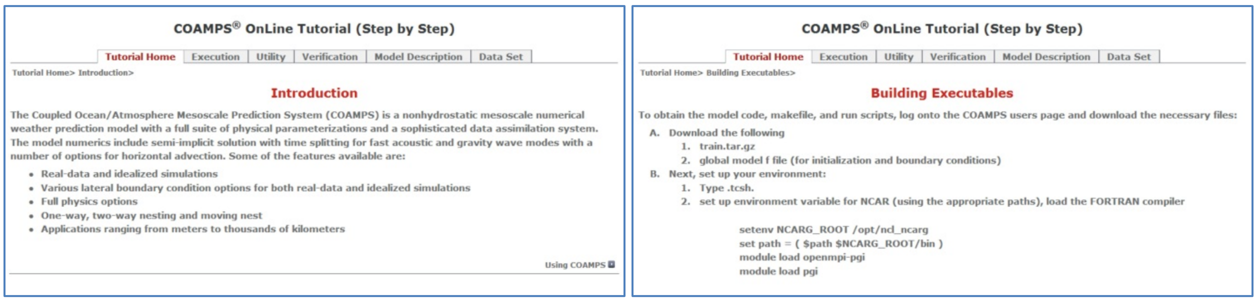

Figure 1. Example of the COAMPS online tutorial website, displaying the entry page (left) and instruction for building the executables (right).

Figure 1 shows examples of the online tutorial with step-by-step instructions. The content of the tutorial is based on the lab materials used during on-site training. Users can follow the instructions at the website and go forward or backward by clicking the arrows at the bottom of the page. The site, designed as a "one-stop-shopping" place, guides the user from downloading the code, compiling the code, running simulations, verification, to making plots.

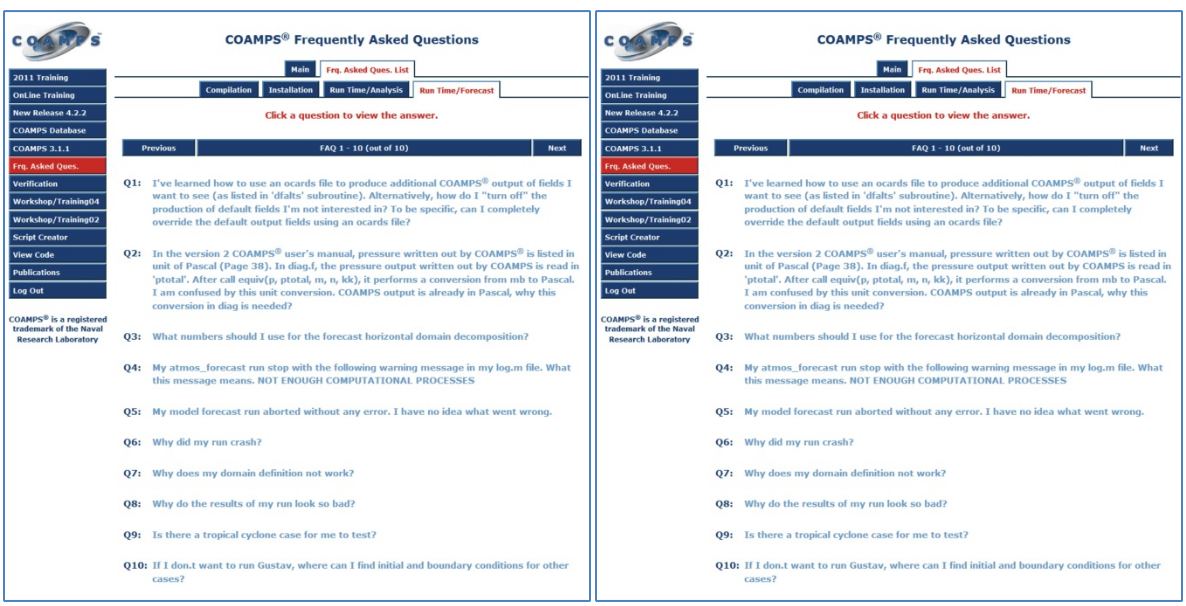

Figure 2. Example of the COAMPS Frequenly Asked Questions (FAQs) (left) and answers (right).

We have compiled our answer to users' questions and add them to the FAQ pages. The FAQs are grouped into several categories (e.g., compilation, installation, etc). Users can get to the answer page by click on the question.

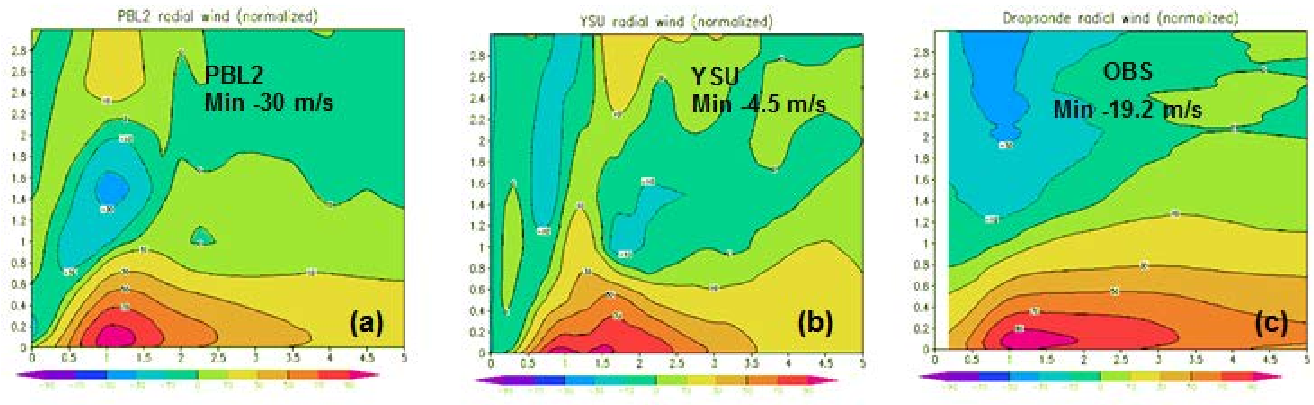

Figure 3.Azimuthally averaged radial flow normalized in the layer from surface to 3 km for COAMPS idealized TC simulations using COAMPS PBL2 scheme (a), the WRF YSU scheme (b), and the composites using dropsonde observations (c). The observations is provided by J. Zhang of HRD. The x-axis is the normalized radial distance, with the eyewall located at x=1. Positive values indicating inflow; negative values for outflow.

Leveraging the COAMPS-TC and HFIP projects, we have been involved in evaluating various PBL schemes to improve TC prediction. One of the newly implemented schemes in COAMPS-TC is the YSU scheme from the WRF repository. The YSU scheme, a non-local scheme, is fundamentally different from the Mellor-Yamada scheme that predicts turbulent kinetic energy. An example of radial inflow/outflow from an idealized TC simulation is given in Fig. 3. While the radial flows are similar in general between the runs using the PBL2 scheme and the YSU scheme, significant differences exists. For example, the height of the inflow in the eyewall is limited below 1 km in the simulation using PBL2 and compares quite well with the dropsonde composite. On the other hand, the YSU simulation extends the inflow up to 1.4 km in the eyewall. The outflow observed in the layer from 1.2-3 km is much weakened in both simulations, and it is more so in the YSU results.

It should be mentioned that during this effort, we worked closely with scientists from the WRF and HFIP community. The observational data from our external collaborators are useful for our model evaluation.

Another major activity under this project is to provide consultation to scientists at OU/CAPS during their effort implementing two versions of the Milbrandt-Yau (M-Y) multi-moment microphysics scheme in COAMPS. One version is the research code used in ARPS that has the option for one moment, two moment and triple moment simulations. Another version is a simplified two-moment scheme that is included in WRF. Both versions are now in their version of COAMPS and the model forecasts finished in reasonable time so COAMPS was included in the 2012 spring real-time ensemble forecasts carried out by OU. Figure 4 displays the synthetic satellite imagery simulated by various models.

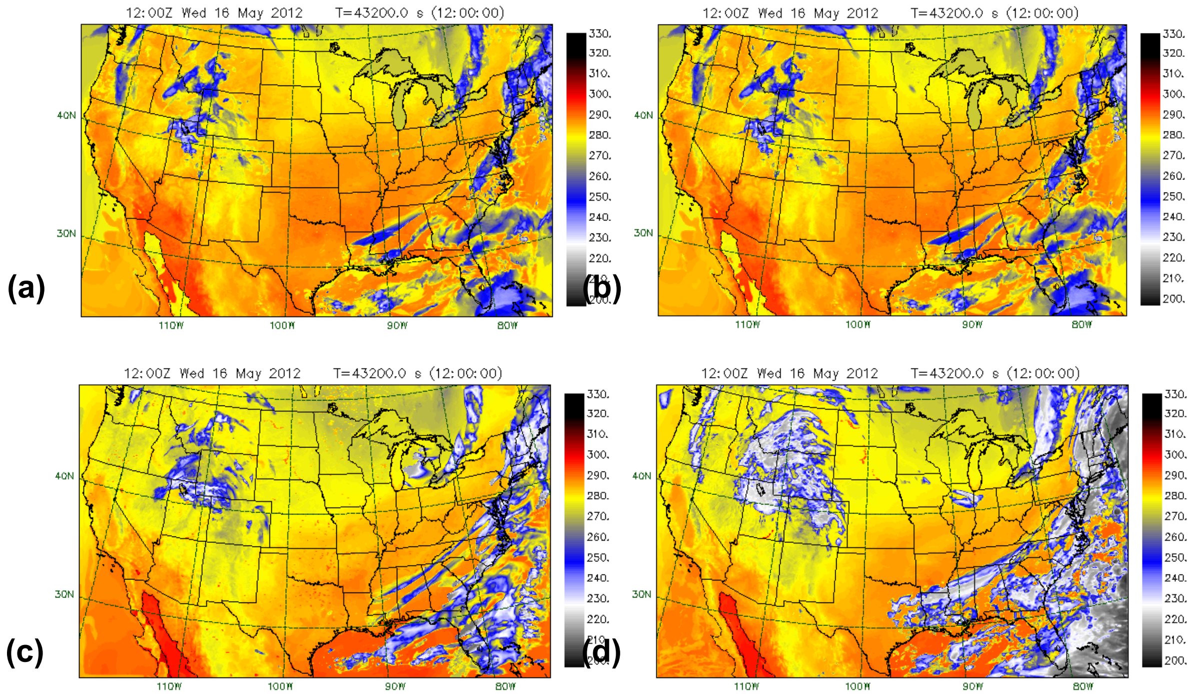

Figure 4. Simulated 10.7 µm brightness temperatures for 12-h forecasts with 4-km grid spacing initialized from 0600 UTC 16 May 2012 from WRF ARW (a), WRF NMM (b), ARPS (C), and COAMPS (d).

IMPACT/APPLICATIONS

Several long term benefits from this project can be identified: 1) improved opportunities for the next generation of atmospheric researchers to contribute to COAMPS development, 2) increased awareness and visibility of COAMPS in the broader scientific community, and 3) accrued credit to NRL and the Navy from academic research performed using COAMPS. We were somewhat hampered in our efforts to work with tier 1 users. The required approval process and legal documentation in some cases caused significant delays in terms of harvesting progress made by external collaborators.

TRANSITIONS

The online tutorial, the addendum to the COAMPS documentation and numerous code dates have been posted online.

RELATED PROJECTS

This project is closely coordinated with the COAMPS-TC RTP jointly supported by ONR and PMW-120 and HFIP project.

PUBLICATIONS

Web posting at the COAMPS training site accessible to registered users.